National Transportation Safety Board
Aviation Accident Final Report

Location:	MILWAUKEE, WI	**Accident Number:**	CHI00FA050
Date & Time:	12/26/1999, 0715 CST	**Registration:**	N422BC
Aircraft:	Israel Aircraft Industries 1124A	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	6 None
Flight Conducted Under:	Part 91: General Aviation - Business		

Analysis

During the activation of the crew oxygen system a fire erupted which consumed the entire pressure vessel. Representatives from the National Aeronautics and Space Administration's (NASA) Johnson Space Center (JSC), White Sands Testing Facility (WSTF), Las Cruces, New Mexico, examined the retained oxygen system components. Examination of these components revealed that the fire's initiation location was the first stage pressure reducer located in the oxygen regulator assembly.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The failure of the first stage pressure reducer in the oxygen regulator assembly.

Findings

Occurrence #1: AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION
Phase of Operation: TAXI

Findings
1. (C) OXYGEN SYSTEM,CREW - FAILURE

Occurrence #2: FIRE
Phase of Operation: TAXI

Factual Information

HISTORY OF FLIGHT

On December 26, 1999, at 0715 central standard time, an Israel Aircraft Industries (IAI) 1124A, N422BC, owned and operated by Bradley Aviation LLC, Menomonee Falls, Wisconsin, sustained substantial damage during an on-ground fire at the General Mitchell International Airport, Milwaukee, Wisconsin. Visual meteorological conditions prevailed at the time of the accident. The positioning flight was operating under the provisions of 14 CFR Part 91 and was not on a flight plan. The pilot-in-command (PIC), second-in-command (SIC) pilot, and four passengers reported no injuries. The flight was taxiing from parking at the time of the accident and the flight's proposed destination was the Waukesha County Airport, Waukesha, Wisconsin.

According to the SIC, as the aircraft taxied out of the parking area he initiated the taxi checklist. The SIC stated that when he opened the oxygen shut-off valve (SOV) a series of sparks originated from the SOV and popping noises were heard. The SIC reported that a "Torch like" flame immediately erupted from the general area that contained the Oxygen Shutoff Valve and flames consumed the cockpit area shortly there after.

According to the PIC, all four passengers were able to evacuate from the aircraft through the left side emergency window exit. The PIC and SIC reported that they evacuated from the aircraft through the main cabin entrance.

PERSONAL INFORMATION

The PIC was the holder of an airline transport pilot certificate and was type rated in four aircraft including the IAI 1124. The PIC was also the holder of commercial and flight instructor certificates for single engine land airplanes. The PIC reported his total flight time as 14,363 hours with 10,408 hours as PIC. The PIC reported that he had accumulated a total of 2,024 hours in the IAI 1124 aircraft and 1,622 hours were as PIC. The pilot reported that his last biennial flight review was completed in an IAI 1124A on August 19, 1999.

Federal Aviation Administration (FAA) records indicate that the PIC was issued a first-class medical certificate with no restrictions or limitations noted on August 24, 1999.

The SIC was the holder of an airline transport pilot certificate and was type rated in the IAI 1124. The SIC was also the holder of commercial and flight instructor certificates for single engine land airplanes. The SIC reported his total flight time as 9,980 hours with 9,430 hours as PIC. The SIC reported that he had accumulated a total of 875 hours in the IAI 1124 and 875 hours were as PIC. The pilot reported that his last biennial flight review was completed in an IAI 1124A on August 19, 1999.

FAA records indicate that the pilot was issued a first-class medical certificate with the limitation that corrective lenses had to be worn while performing pilot duties on April 6, 1999.

AIRCRAFT INFORMATION

The IAI 1124A is a production built, twin turbo-fan, business jet. The IAI 1124A has a range of 2,904-nm, at a recommended cruise speed of 415-knots, accommodates a crew of two and up to ten passengers with a maximum gross weight of 23,500-lbs.

According to aircraft service and maintenance records, the aircraft had accumulated a total time of 7,974.8 hours. The airplane operator maintained the airplane according to the

manufacturers inspection program. The last maintenance check was conducted on August 20, 1999. The airplane had accumulated 116.0 hours since the last inspection.

The aircraft was powered by two Garrett TFE731-3-1G turbofan engines, rated at 3,700-lbs of thrust each.

METEOROLOGICAL INFORMATION

The General Mitchell International Airport, Milwaukee, Wisconsin, reported the weather 12 minutes after the accident as:

Observation Time: 0727 cst Wind: 320-degrees at 15 knots Gusting to 31 knots Visibility: 10 statute miles Sky Condition: 600 feet agl Scattered Temperature: -02 degrees centigrade Dew Point Temperature: -12 degrees centigrade Pressure: 29.89 inches of mercury

WRECKAGE AND IMPACT INFORMATION

Examination of the wreckage revealed that a sustained ground fire had consumed the entire pressure vessel from the forward pressure bulkhead to the aft pressure bulkhead. On the right side of the aircraft, located approximately at the oxygen regulator, a hole was burned through the aircraft pressure vessel. A high-pressure oxygen line was observed to be protruding from a hole in the fuselage skin. The forward end of this line remained attached to the oxygen system shut-off valve. The other end was found unattached, protruding outside of the fuselage. The high-pressure line leading to the oxygen shut-off valve was observed to have a fish-mouth burst and heat discoloration. The control column, located to the left of the fish-mouth burst, was found lying on the floor next to the center consol. See attached photographs for additional wreckage documentation.

FIRE

Inspection of the wreckage indicated that a fire in the oxygen system had been the primary source of fire. The oxygen bottle, its regulator, the oxygen shut-off valve, and all oxygen lines were retained for examination. All remaining debris, found on the right side-wall of the cockpit, was also recovered for examination.

Representatives from the National Aeronautics and Space Administration (NASA) Johnson Space Center (JSC), White Sands Testing Facility (WSTF), Las Cruces, New Mexico, examined all retained components and debris.

According to reports generated by the NASA WSTF staff, the oxygen cylinder was found to be within cleanliness certification limitations.

The fish-mouth burst was characterized as, "...a ductile fracture initiated by a thermal-cutting process. Flame impingement on a localized region of the tubing reduced the wall thickness until an overload failure occurred, generating the observed deformation. The resulting fracture surfaces were consumed by the ensuing fire. No evidence of a defect in the tubing material was revealed by the analysis."

The oxygen shut-off valve was tested and functioned properly. A disassembly of the shut-off valve revealed that there was no seating material present on the valve-stem and was most likely consumed in the fire.

The oxygen system hardlines were evaluated for cleanliness and, "The results indicate that the oil contamination levels (i.e., NVR) were within those typically allowed of oxygen systems." Some particulate was noted in the hardlines and, "The particulate profile was consistent with a blowdown of the oxygen cylinder during the course of the fire." Organic residue was identified in a section of the oxygen hardline, and after spectrum analysis the residue was determined to be, "...similar to surfactants used in fire-fighting foams and may have been introduced during the extinguishment of the fire."

NASA document "Data Collection Summary Report" is attached to this factual report.

TESTS AND RESEARCH

National Transportation Safety Board (NTSB) accident records revealed that a similar accident, involving a IAI 1124, occurred on February 21, 1995, at the Denver-Stapleton International Airport, Denver, Colorado.

According to the NTSB factual report, "According to the first officer who was conducting cabin checks with no power on the aircraft, he turned on the oxygen valve, heard a loud hissing sound and an immediate fire occurred. The first officer evacuated the aircraft and local ramp personnel extinguished the fire before the airport fire department arrived. However, the cabin and flight deck were scorched with substantial melting, and a large hole was burned in the pressure vessel in the vicinity of the oxygen regulator."

The NTSB determined the probable cause of the accident was, "an oxygen leak at the oxygen system pressure reducer-regulator assembly, resulting in a crew compartment fire."

ADDITIONAL DATA/INFORMATION

Parties to the investigation were:

Federal Aviation Administration, Flight Standards District Office, Milwaukee, Wisconsin.

Galaxy Aerospace Company, Fort Worth, Texas.

The main wreckage was release to a representative of the owner's insurance company on January 6, 2000.

Pilot Information

Certificate:	Airline Transport; Commercial	**Age:**	53, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Seatbelt, Shoulder harness
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane Single-engine	**Toxicology Performed:**	No
Medical Certification:	Class 1 Valid Medical--no waivers/lim.	**Last FAA Medical Exam:**	08/24/1999
Occupational Pilot:		**Last Flight Review or Equivalent:**	
Flight Time:	14363 hours (Total, all aircraft), 2024 hours (Total, this make and model), 10408 hours (Pilot In Command, all aircraft), 125 hours (Last 90 days, all aircraft), 30 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Israel Aircraft Industries	**Registration:**	N422BC
Model/Series:	1124A 1124A	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	No
Airworthiness Certificate:	Normal	**Serial Number:**	302
Landing Gear Type:	Retractable - Tricycle	**Seats:**	0
Date/Type of Last Inspection:	08/20/1999, Continuous Airworthiness	**Certified Max Gross Wt.:**	23500 lbs
Time Since Last Inspection:	116 Hours	**Engines:**	2 Turbo Fan
Airframe Total Time:	7975 Hours	**Engine Manufacturer:**	Garrett
ELT:		**Engine Model/Series:**	TFE731-3-1G
Registered Owner:	BRADLEY AVIATION LLC	**Rated Power:**	3700 lbs
Operator:	BRADLEY AVIATION LLC	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	**Condition of Light:**	Dawn
Observation Facility, Elevation:	MKE, 723 ft msl	**Distance from Accident Site:**	0 Nautical Miles
Observation Time:	0727 CST	**Direction from Accident Site:**	0°
Lowest Cloud Condition:	Scattered / 6000 ft agl	**Visibility**	10 Miles
Lowest Ceiling:	None / 0 ft agl	**Visibility (RVR):**	0 ft
Wind Speed/Gusts:	15 knots / 31 knots	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	320°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29 inches Hg	**Temperature/Dew Point:**	28°C / 11°C
Precipitation and Obscuration:			
Departure Point:	(MKE)	**Type of Flight Plan Filed:**	None
Destination:	WAUKESHA, WI (UES)	**Type of Clearance:**	
Departure Time:	0715 CST	**Type of Airspace:**	Class C

Airport Information

Airport:	GENERAL MITCHELL INTL (MKE)	**Runway Surface Type:**	
Airport Elevation:	723 ft	**Runway Surface Condition:**	
Runway Used:	0	**IFR Approach:**	
Runway Length/Width:		**VFR Approach/Landing:**	

Wreckage and Impact Information

Crew Injuries:	2 None	**Aircraft Damage:**	Substantial
Passenger Injuries:	4 None	**Aircraft Fire:**	On-Ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	6 None	**Latitude, Longitude:**	

Administrative Information

Investigator In Charge (IIC):	ANDREW T FOX	**Report Date:**	09/26/2001
Additional Participating Persons:	CATHY VUKSANOVIC; MILWAUKEE, WI GARY CONOVER; NILES, MI		
Publish Date:			
Investigation Docket:	NTSB accident and incident dockets serve as permanent archival information for the NTSB's investigations. Dockets released prior to June 1, 2009 are publicly available from the NTSB's Record Management Division at pubinq@ntsb.gov, or at 800-877-6799. Dockets released after this date are available at http://dms.ntsb.gov/pubdms/.		